GCF Wideband Switch Subassembly— Application Techniques

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Application techniques used in the development of the wideband switch subassembly (WBSS) are discussed. The WBSS is a part of the Ground Communication Facility's (GCF's) wideband subsystem located in the Central Communications Terminal at JPL. It is used to support the Mariner Venus/Mercury 1973 and Viking operations. The WBSS is a complex switching unit that provides for simple control by the operator for effecting the many interconnect configurations of various data sets, coded multiplexers/demultiplexers, and JPL computer systems.

I. Introduction

In FY 1972 the Deep Space Network established functional operations requirements for providing wideband data support to the Mariner Venus/Mercury 1973 and Viking flight projects. The requirements specified complete versatility in providing interchange configurations for wideband data. To meet these requirements the Ground Communications Facility had to devise unique application techniques.

This article discusses the concepts utilized in providing a reliable and easily operated interchanger of wideband data for the Central Communications Terminal (CCT) at JPL. The wideband switch subassembly (WBSS) has been "on-line" since July 1973, and has proven its reliability and ease of operation in service to the Mission Control and Computing Center, Deep Space Stations, and project locations.

II. Requisite Review

The operational requirements presented in the referenced article describe the complexity of this switching unit. Specifically, it has the capability of arranging 626 interconnecting configurations of data sets (DSs), coded multiplexers (CMDs), and local computer systems, herein referred to as on-site computers (OSCs). The number of signal lines involved per switched interconnection varies from 3 to 6.

The ease with which an operator can program a configuration or interpret those configurations in effect is of

great importance. Factors that could confuse an operator during a critical or busy period must be eliminated.

III. Operator Controls and Indicators

Much attention was given to panel-layout details in order to provide the operator with a positive and readily-recognizable control and display presentation. Since the WBSS is basically a switching matrix, the format of controls and indicators is presented in matrix form to the operator for. an associative effect. The control and indicator format is shown in Fig. 1. Briefly, the following are the functions provided. The operator may address any one of the DSs, CMDs, or OSCs by depressing push-buttons ① and ②. The operator may then "enter" or "release" an interconnection (③ and ④, respectively) or "erase" ⑤ an erroneous address selection. This momentary illumination of a light-emitting diode (LED) verifies completion of these three operations (SEQUENCE COMPLETE, ⑥).

Interpretation of the effected interconnections is accomplished by observing the relative positions of illuminated LEDs ⑦ in the display matrices. Pushbuttons 8 and ⑨ aid in the identification of a crosspoint indication by illuminating an entire horizontal row or vertical column of LEDs, respectively.

Data are switch-routed on the basis of the direction they flow with respect to the OSCs, either "inbound" or "outbound." They are further routed on the basis of the data stream format (e.g., multiplexed, nonmultiplexed, demultiplexed, or regenerated).

IV. Programming Circuits

Behind each of the two control and display panels is a wireplane housing integrated circuits (ICs) that accept the operator's pushbutton inputs and convert these to an ordered sequence of logic commands that control the crossbar switches. See Fig. 2.

These ICs also continuously interrogate the crossbar matrices for contact closures and present the closed-path configuration information via the LED matrices. This monitoring function requires only one level of the cross-bar matrix (i.e., a single contact closure is all that is required for active crosspoint identification).

The crossbar switches are mounted on two fully-extending vertical slides located in a separate equipment bay. See Fig. 3.

V. Summary

The objectives of this project have been achieved. The WBSS is reliable, straightforward in its operation, and easy to maintain. The design techniques used in its planning and the construction techniques used in its fabrication have provided these qualities.

References

1. Bird, E. F., "GCF Wideband Switch Subassembly—Requirements and Design Concept," in *The Deep Space Network Progress Report for September and October 1973*, Technical Report 32-1526, Vol. XVIII, pp. 117–119. Jet Propulsion Laboratory, Pasadena, Calif., December 15, 1973.

2. *Wideband Switch Subassembly*, Technical Manual TM 509286. Jet Propulsion Laboratory, Pasadena, Calif., May 30, 1974.
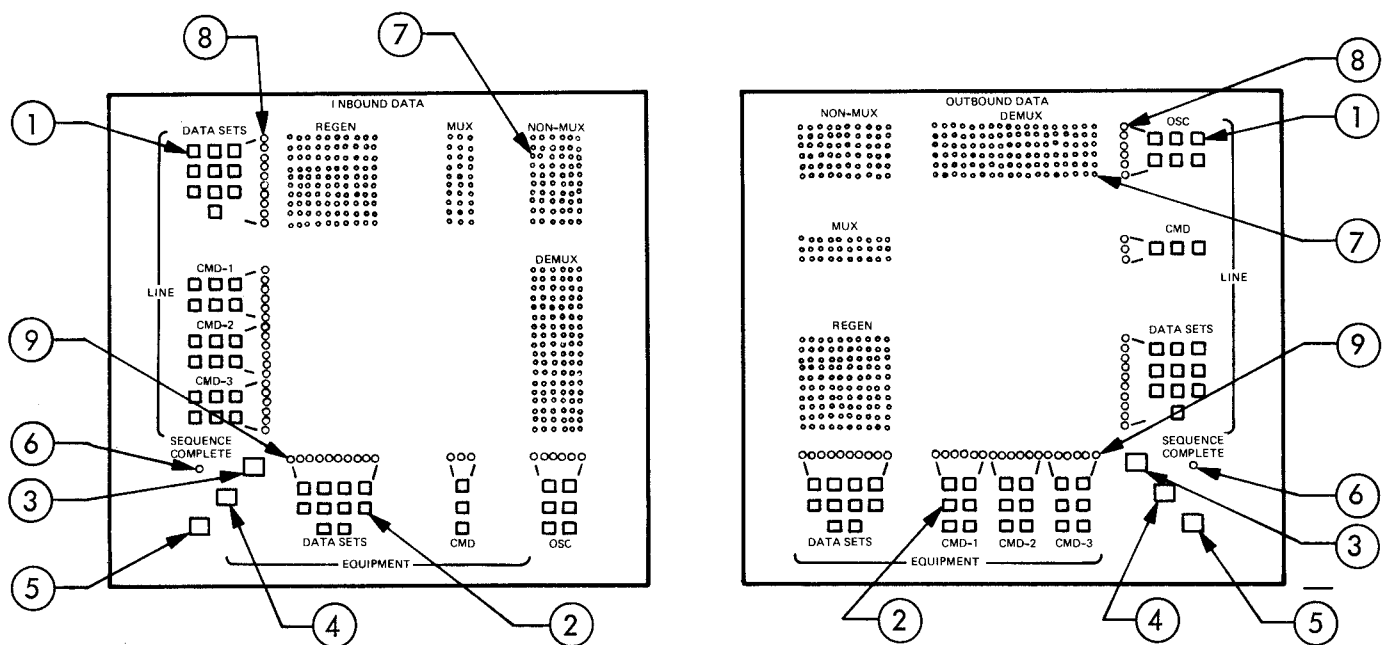
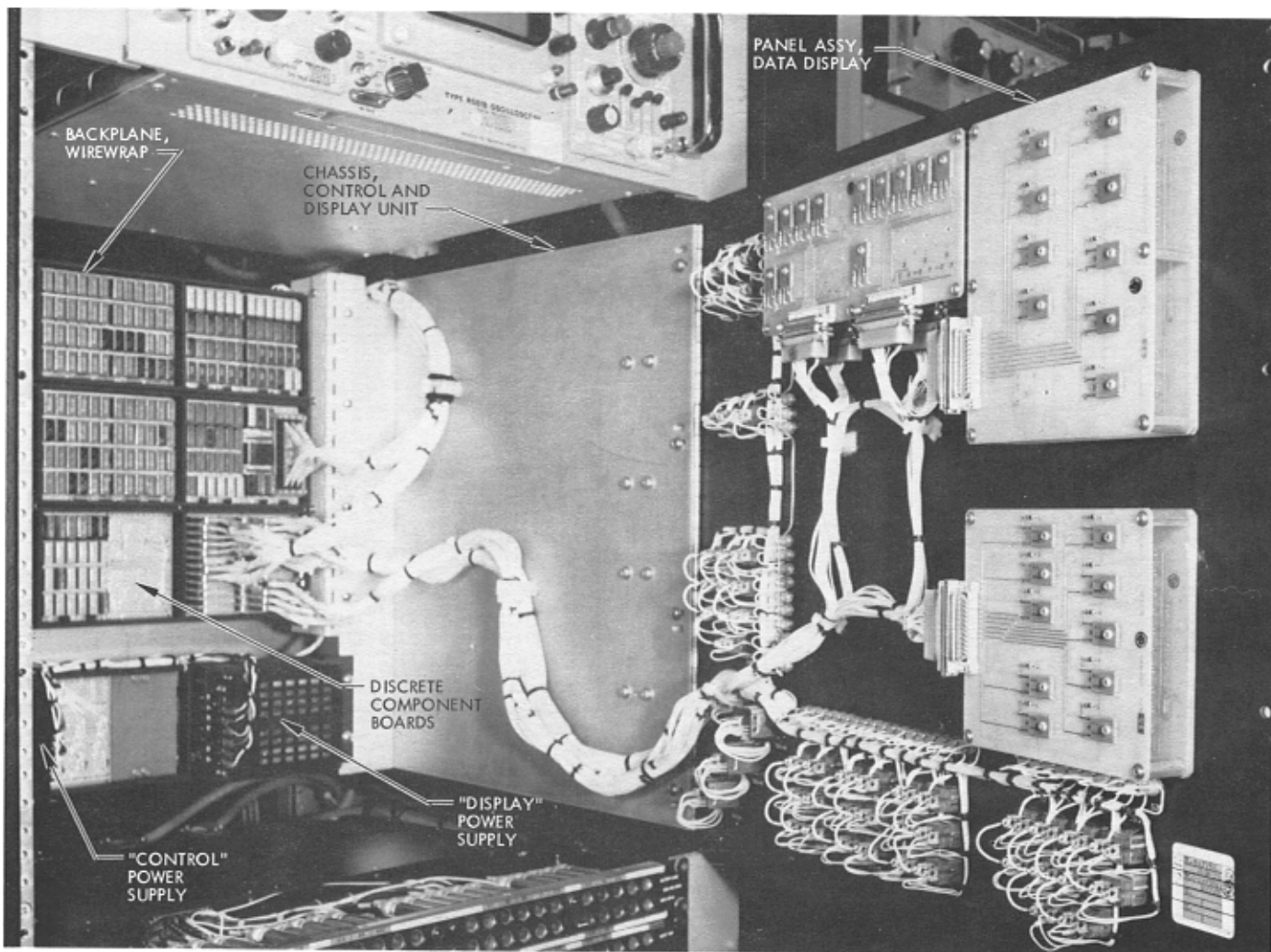Fig. 1. Control and display units—controls and indicators

Fig. 2. Outbound control and display unit—parts location
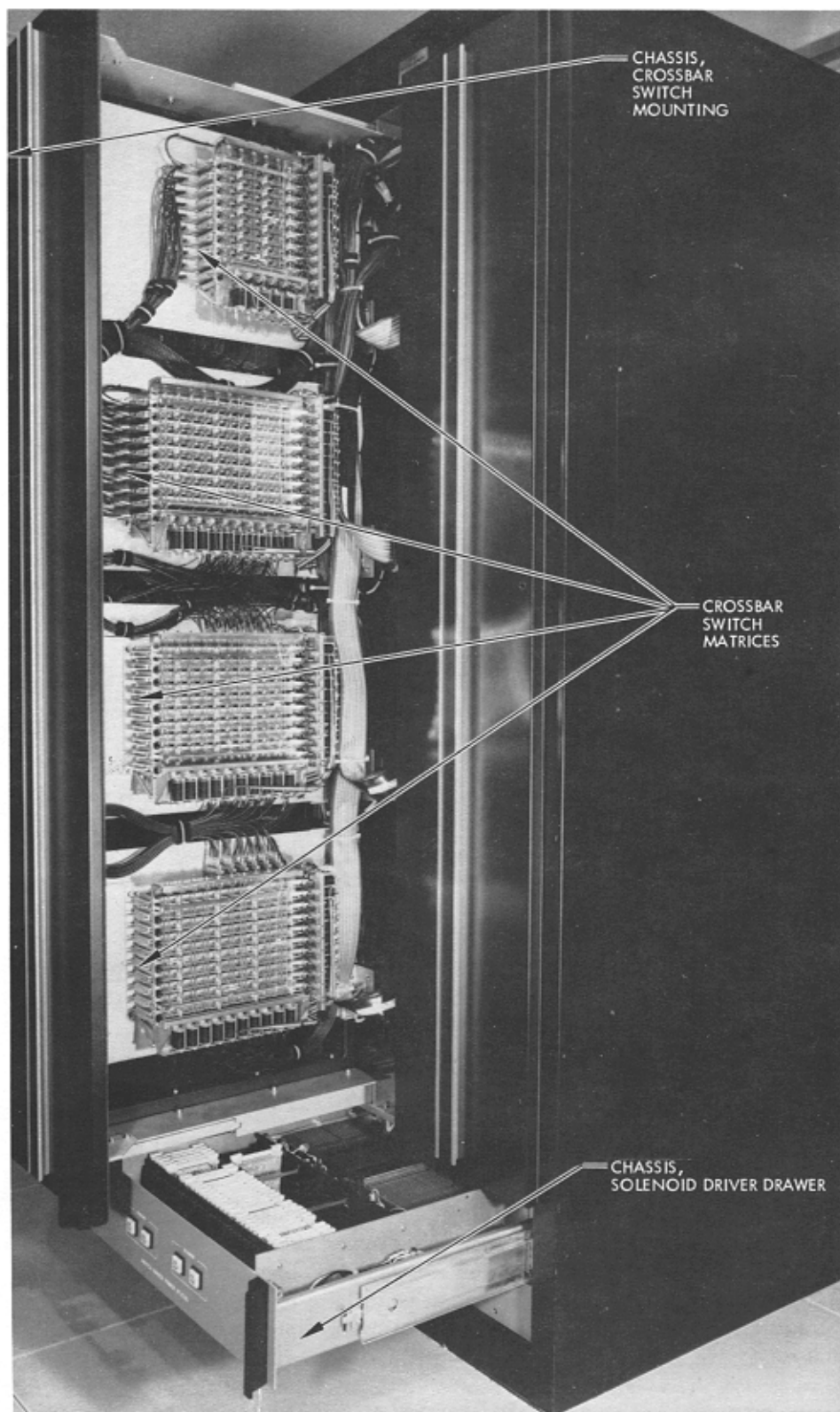
CHASSIS,
CROSSBAR
SWITCH
MOUNTING

CROSSBAR
SWITCH
MATRICES

CHASSIS,
SOLENOID DRIVER DRAWER

Fig. 3. Crossbar switch cabinet